इंटरनेट मानक

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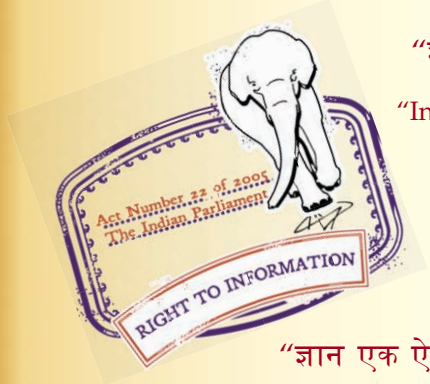
"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 12160 (1987): Technical Drawings - Fundamental Tolerancing Principle [PGD 24: Drawings]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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UDC 744·43 : 621·753·1 (First Reprint JUNE 1998) IS : 12160 - 1987 (Reaffirmed 1993)

(Reaffirmed 1999)

Indian Standard

TECHNICAL DRAWINGS — FUNDAMENTAL TOLERANCING PRINCIPLE

Drawings Sectional Committee, EDC 20; Drawings Subcommittee, EDC 20 : 1 [Ref : Doc : EDC 20 (4953)]

1. Scope — Specifies the principle of the relationship between dimensional (linear and angular) tolerances and geometrical tolerances.

2. Field of Application — The specified principle shall be applied on technical drawings and related technical documents to linear dimensions and their tolerances, angular dimensions and their tolerances; geometrical tolerances; which define the following four aspects for each feature of the part:

size;

form;

orientation;

location.

3. References

IS : 919 (Part 1)-1963 Recommendations for limits and fits for engineering: Part 1 General engineering (*first revision*)

IS : 8000 (Part 1)-1985/ISO 1101-1983 Geometrical tolerancing on technical drawings: Part 1 Tolerances of form, orientation, location and run-out, and appropriate geometrical definitions

IS : 8000 (Part 2)-1976 Geometrical tolerancing on technical drawings: Part 2 Maximum material principles

4. Principle of Independency — Each specified dimensional or geometrical requirement on a drawing shall be met independently, unless a particular relationship is specified.

4.1 Therefore, where no relationship is specified, the geometrical tolerance applies regardless of feature size, and the two requirements are treated as being unrelated.

4.1.1 Consequently, if a particular relationship of size and form, or size and orientation, or size and location is required, it shall be specified on the drawing (*see* **6**).

5. Tolerances

5.1 *Dimensional Tolerances*

5.1.1 *Linear tolerances* — A linear tolerance controls only the actual local sizes (two point measurements) of a feature, but not its form deviations (for example, circularity and straightness deviations of a cylindrical feature or flatness deviations of two parallel plane surfaces) [*see* IS : 919 (Part 1)-1963].

5.1.1.1 Form deviations shall, however, be controlled by the following:

— individually indicated form tolerances;

— general geometrical tolerances;

— envelope requirement.

Note — For the purpose of this standard, a single feature consists of a cylindrical surface or two parallel plane surfaces.

There is no control of the geometrical interrelationship of individual features by the linear tolerances. For example, the perpendicularity of the sides of a cube is not controlled and, therefore, it requires a perpendicularity tolerance dictated by the design requirement.

5.1.2 *Angular tolerances* — An angular tolerance, specified in angular units, controls only the general orientation of lines or line elements of surfaces, but not their form deviations (*see* Fig. 1).

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

5.1.2.1 *The general orientation of the line derived from the actual surface is the orientation of the* contacting line of ideal geometrical form (*see* Fig. 1). The maximum distance between the contacting line and the actual line shall be least possible value.

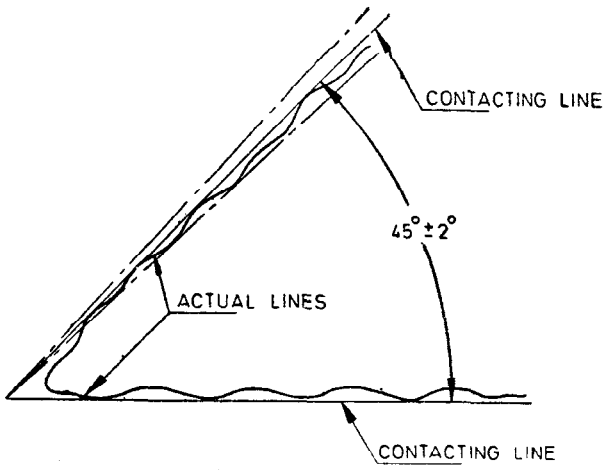


FIG. 1

5.1.2.2 Form deviations shall, however, be controlled by the following:

— individually indicated form tolerances;

— general geometrical tolerances.

5.2 *Geometrical Tolerances* — Geometrical tolerances control the deviation of the feature from its theoretically exact form or orientation or location regardless of the feature size.

5.2.1 The geometrical tolerances will, therefore, apply independently of the actual local sizes of individual features (*see* **4**). The geometrical deviations may be at a maximum whether or not the cross-sections of the respective features are at maximum material size.

5.2.2 For instance, a shaft with maximum material size at any cross-section may have a lobed form deviation within the circularity tolerance, and may also be bent by the amount of the straightness tolerance (*see* Fig. 2).

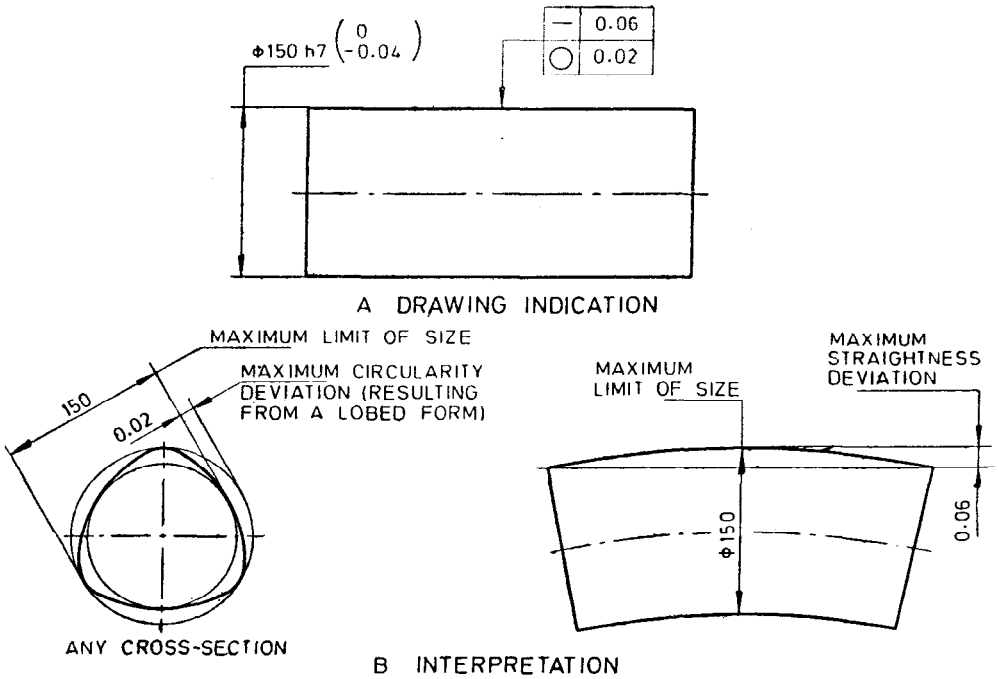


FIG. 2

6. Mutual Dependency of Size and Geometry — Mutual dependency of size and geometry may be called for by:

— the envelope requirement (*see* **6.1**);

— the maximum material principle (*see* **6.2**).

6.1 *Envelope Requirement* — For a single feature either a cylindrical surface or a feature established by two parallel plane surfaces (feature of size), the envelope requirement may be applied. The requirement means that the envelope of perfect form at maximum material size of the feature shall not be violated.

6.1.1 The envelope requirement may be indicated either:

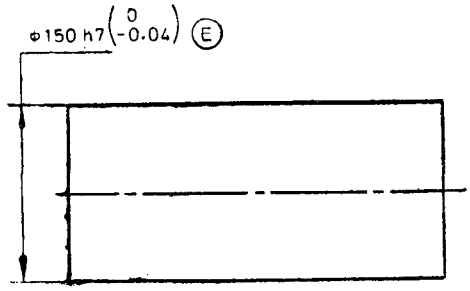
by the symbol Ⓔ placed after the linear tolerance (*see* Fig. 3A), or

by reference to an appropriate standard which invokes the envelope requirement.

Example:

Envelope requirement applied to a cylindrical feature

a) *Drawing indication*



3A

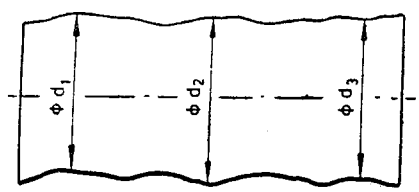
b) *Functional requirements*

— The surface of the cylindrical feature shall not extend beyond the envelope of perfect form at maximum material size of ϕ150.

— No actual local size shall be less than ϕ149·96.

This means that the actual part shall meet the following requirements:

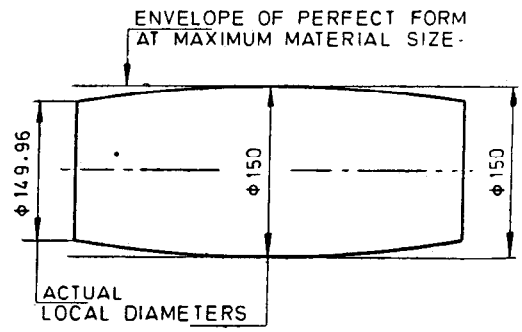
— each actual local diameter of the shaft shall remain within the size tolerance of 0·04 and, therefore, may vary between ϕ150 and ϕ149·96 (*see* Fig. 3B);



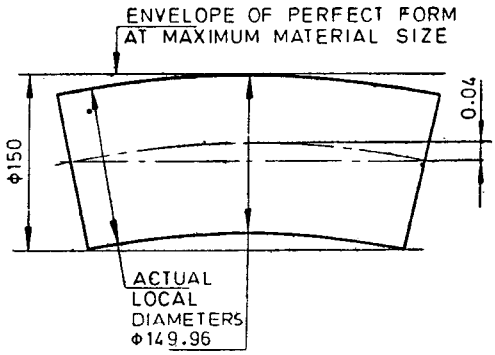
d_1, d_2, d_3 ACTUAL LOCAL DIAMETERS

3B

— the entire shaft shall remain within the boundary of the envelope cylinder of perfect form and of ϕ150 (*see* Fig. 3C and 3D).

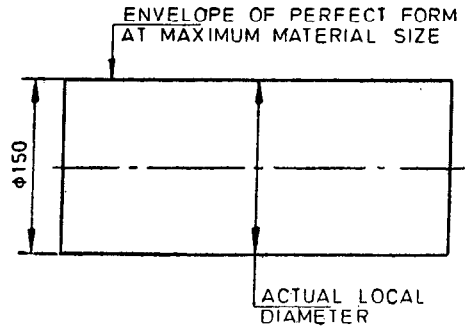


3C



3D

6.1.1.1 Hence it follows that the shaft be exactly cylindrical when all actual local diameters are at the maximum size of ϕ150 (*see* Fig. 3E).



3E

6.2 *Maximum Material Principle* — If, for functional and economic reasons, there is a requirement for the mutual dependency of the size and orientation of location of the feature(s), then the maximum material principle Ⓜ may be applied [*see* IS : 8000 (Part 2)-1976].

7. Application on Drawings

7.1 *Completeness of Drawing* — The drawing should specify dimensional and geometrical tolerances necessary to check the part completely for its function.

7.2 *Designation* — Drawings to which the principle of independency applies shall be identified by being marked in or close to the drawing title block as follows:

Tolerancing IS : 12160

7.2.1 This indication shall be supplemented by a reference to the appropriate standard general geometrical tolerances or to other related documents.

EXPLANATORY NOTE

This standard is based on ISO 8015-1985 'Technical drawings — Fundamental tolerancing principles', issued by the International Organization for Standardization (ISO).

In ISO standard, size of tolerance values are one size lower than basic size whereas in this standard both the values are of same size as per the latest principles of ISO in this regard.